DEVELOPMENT OF A CASE MIX BASED REIMBURSEMENT METHOD FOR HOSPITAL OPDS AND FREE-STANDING CLINICS

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The opinions contained in this final report are those of the Brandeis project staff and do not necessarily reflect the views or policies of the Health Care Financing Administration. The project staff and Brandeis University assume responsibility for the accuracy and completeness of the data and other information contained in this report.

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Bellevue Hospital Center
The Brookdale Hospital Medical Center
Lutheran Medical Center
Beth Israel Medical Center

Boston hospital outpatient departments

Boston City Hospital
New England Medical Center
Beth Israel Hospital
Dana Farber Cancer Institute

Boston neighborhood health centers

Dorchester House Multi Service Center
East Boston Neighborhood Health Center
Harvard Street Neighborhood Health Center
South Boston Neighborhood Health Center
South Cove Community Health Center
Southern Jamaica Plain Community Health Center
Mattapan Neighborhood Health Center

LIST OF PUBLICATIONS RESULTING FROM THIS PROJECT

Lion, Joanna, Mary Henderson, Andrew Bergman, and Alan Malbon, "The Second Generation of Ambulatory Visit Groups: How They Perform in a Hospital-Based Specialty", Health Policy Center, Heller School, Brandeis University, March, 1986. (Forthcoming in the *Journal of Ambulatory Care Management*.)

Hereford, Russell, W., Joanna Lion, and Mary Henderson, "Case Mix Differences in Public and Voluntary Hospital Adult Medicine Clinics", Health Policy Center, Heller School, Brandeis University, May, 1986. (Submitted to the *American Journal of Public Health*.)

Lion, Joanna, Alan Malbon, Andrew Bergman, and Mary Henderson, "Inpatient vs. Outpatient Chemotherapy: A Comparison of Case Mix and Charges", Health Policy Center, Heller School, Brandeis University, July, 1986. (Submitted to the *Health Care Financing Review*.)

Lion, Joanna, Alan Malbon, and Andrew Bergman, "Ambulatory Visit Groups: Implications for Hospital Outpatient Departments, Health Policy Center, Heller School, Brandeis University, August, 1986. (Forthcoming in the *Journal of Ambulatory Care Management*.)

Henderson, Mary, Joanna Lion, and Christine Bishop, "Adult Primary Care in the Hospital Outpatient Department and the Community Health Center", Health Policy Center, Heller School, Brandeis University, October, 1986.

EXECUTIVE SUMMARY

The purpose of this grant was to collect hospital outpatient department and neighborhood health center data on a visit specific basis and to use these data to develop and test a case-mix-based reimbursement scheme based on the resource intensity of the visits. Priority was to be given to testing the suitability for analyzing clinic care of the ambulatory visit groups (AVGs) being developed concurrently by Yale University. Ambulatory visit groups are the outpatient equivalent of diagnostic related groups (DRGs), also developed by Yale.

Data were collected for 10,145 visits to primary care clinics in Boston and New York City. Of these, 7,531 visits were to adult general medicine clinics, 1,909 to pediatric clinics, and 705 to obstetrics-gynecology clinics. A tertiary specialty with high resource use, a high number number of clinic visits and a high proportion of Medicare recipients was also selected to further refine the scheme. This specialty was oncology: 2,001 visits were collected to medical oncology clinics and 1,050 to radiation therapy clinics. The data were collected using a standard format adapted from the National Ambulatory Medical Care Survey (NAMCS).

The major findings of the data analysis were:

- Physician time (the only resource use variable available in NAMCS) is inappropriate as a measure of hospital clinic resource use. Almost sixteen percent of visits to adult medicine clinics lacked physician time. This reached 23 percent of pediatric clinic visits, about 30 percent of medical oncology visits, and about half of obstetrics-gynecology and radiation therapy visits.

- For adult medicine, physician time is rather highly correlated with total provider time (.83) for those visits having physician time. Physician time and provider time are less highly correlated (.63) for medical oncology.

- A resource use measure consiting of weighted physician time and other provider time, added to the cost of all tests ordered or performed at that visit, appears to give the best measure of direct resource use. The correlations between total resource use and physician time were quite low (.32 for adult medicine and .21 for medical oncology).

- Hospital OPDs were substantially and significantly more resource intensive than neighborhood health centers for the same type of visit. Public hospital clinics were slightly but insignificantly more resource intensive for a visit than were voluntary OPDs.

- The most resource intensive primary care AVGs were for cardiology procedures. These were EKG monitoring, cardiac ultrasound and cardiac stress testing. The least expensive AVGs were for pediatrics. These were otitis media in an old patient and ENT trauma in both old and new patients.

- Coefficients of variation for the Yale primary care AVGs are somewhat higher than for the medical DRGs. The Yale oncology AVGs have substantially better coefficients of variation (.37-.88) than do the primary care AVGs.

- Because the Yale medical oncology AVGs described resource use variability reasonably well, the Brandeis group was unable to do much better than the Yale group in reducing variation by splitting the oncology visit groups differently.

This study has substantial policy importance in the area of reimbursing for ambulatory care on a case-mix adjusted basis. Independently of reimbursement, comparisons among the product lines of hospital and the free-standing clinics are feasible using the Yale AVGs.

INTRODUCTION

The purpose of this grant was to collect hospital outpatient department and neighborhood health center data on a visit specific basis. These data were then used to develop and test a case-mix-based reimbursement scheme based on the resource intensity of the visits. Priority was to be given to testing the suitability for hospital clinic care of the ambulatory visit groups (AVGs) being developed concurrently on HCFA Grant 18P-98361 by Yale University. Ambulatory visit groups are the outpatient equivalent of diagnostic related groups (DRGs), also developed by Yale.

The major portion of this final report is presented as five articles which have been submitted for publication. These articles are shown in the list of publications and are included as appendices to this report. The order of the articles in the appendices is as follows:

"The Second Generation of Ambulatory Visit Groups: How They Perform in a Hospital-Based Specialty" - Appendix I.

"Case Mix Differences in Public and Voluntary Hospital Adult Medicine Clinics" - Appendix II.

"Inpatient vs. Outpatient Chemotherapy: A Comparison of Case Mix and Charges" - Appendix III.

"Ambulatory Visit Groups: Implications for Hospital Outpatient Departments" - Appendix IV.

"Adult Primary Care in the Hospital OPD and the Community Health Center" - Appendix V.

INITIAL OBJECTIVES

The initial objectives were to compare different types of clinic settings in their use of resources, to develop reasonable visit grouping methodologies, and to test the new Yale AVGs using clinic-based data.

A continuing goal throughout the study was to assess the impact of a case mix based reimbursement scheme when drawing comparisons between different clinic settings. It became obvious early on that using only physician time as a measure of resource use would distort the clinic experience relative to office-based practice. Thus, a large proportion of the study time was devoted to developing and testing various measures of resource use. These included:

- physician time
- provider time
- total resource use including all tests
- total billed charges.

Because of the heavy HCFA investment in the Yale ambulatory visit groups and the interest these groups generated, the Brandeis research concentrated mostly on comparing different clinic settings and testing the AVGs. It was felt to be counter-productive to develop a complete set of groups de novo. Rather, this research concentrated on developing alternatives to the Yale groups only for visits with both high total resource use and high variability. This was done for medical oncology only.

A final objective in the third year of the study was to investigate the relationship of inpatient to outpatient care for a procedure common to both settings. This was done for one component of medical oncology, intravenous chemotherapy.

STUDY METHODOLOGY

A. Brandeis Data Collection

Data were collected on 10,145 visits to primary care clinics in Boston and New York City. Of these, 7,531 were visits to adult general medicine clinics, 1,909 to pediatric clinics, and 705 to obstetrics-gynecology clinics. A tertiary specialty with high resource use, a high number number of clinic visits and a high proportion of Medicare recipients was also selected to further refine the scheme. This specialty was oncology: 2,001 visits were collected to medical oncology clinics and 1,050 to radiation therapy clinics.

All data on visits were collected using a questionnaire used by the National Center for Health Statistics for the National Ambulatory Medical Care Survey (NAMCS). This questionnaire, which had previously been used only for collecting data from office-based physicians, was modified by the Brandeis University staff for hospital clinic use. The major modification involved the addition of time spent with the patient for providers seen in a hospital based setting but are not usually seen in a physician's private office. These included nurse practitioners, radiation therapists, and social workers. NAMCS collects only physician time. Another modification enabled the collection of diagnostic test and therapeutic procedure data in such a way that these tests and procedures could be converted to CPT-4 coding. This was necessary in order to test the Yale AVGs, which were ultimately developed using CPT-4 codes.

A two-week survey period was used in most clinics. During the survey period, a questionnaire was attached to each patient record prior to the visit. All providers involved in the visit filled out the part of the survey that was relevant to the care they provided. Each provider kept track of the time spent with patients and indicated this on the questionnaire. A Brandeis staff member was present in each clinic during the entire study to collect demographic information from patient charts and answer questions.

Because of the presence of Brandeis researchers in the clinics during the study period, very high completion rates were accomplished. For adult medical care, 93.1 percent of the questionnaires were returned, for pediatrics 88.1 percent, and for ob-gyn 88.9 percent. A rigorous process of rejecting returned questionnaires which lacked either a primary diagnosis or any indication of provider time reduced the overall completion rate to 88.9 for adult medicine, 87.2 for pediatrics and 87.2 for ob-gyn.

The medical oncology and radiation therapy questionnaires yielded a final usable questionnaire rate for medical oncology of 82.8 percent and for radiation therapy of 88.2 percent. For oncology, CPT-4 coding could not encompass the value of drugs used in chemotherapy. Since these drugs are such an important component of total resource use in medical oncology, billed charges, including chemotherapy drugs administered, were obtained for oncology rather than using the conversions described for primary care. Any visit for which billed charges could not be obtained nor calculated using standard dosages and a known chemotherapeutic drug was eliminated from the total completion rate for medical oncology.

The percentage completion rates by specialty for Brandeis compare favorably with those obtained in the National Ambulatory Medical Care Survey for physicians in office-based practice. These rates have ranged from about 40 to about 75 percent, with an overall completion rate in the 1981 NAMCS of about 60 percent. Copies of the Brandeis adaptations of the NAMCS questionnaire are contained in Appendix VI. Unlike the NAMCS questionnaire, which is the same for all specialties, the Brandeis questionnaires have each been modified slightly to make them specialty specific. They are also color-coded by specialty.

B. The Yale Ambulatory Visit Groups

Concurrent with the Brandeis data collection, the School of Management at Yale University developed a set of ambulatory visit groups, also using HCFA funding (Schneider et al., 1986). These 571 groups are actually the second generation of a set of groups previously developed in 1978 (Fetter, 1981, Lion et al., 1984). One of the major purposes of the data collection under the Brandeis grant was to evaluate these AVGs as a potential reimbursement scheme for non-office-based visits.

The second generation ambulatory visit groups are based upon 19 major diagnostic categories, similar to the format of DRGs. Each of these major diagnostic categories then is divided according to whether a significant procedure was performed. If a procedure was performed, the groups are further divided according to type of procedure. If a procedure was not performed, the major diagnostic category is split again, based on established versus new patient status. Both old and new patient groups are then categorized into more discrete, identical diagnostic classifications. The process of forming the groups is shown in Figure 1.

Figure 1

CONSTRUCTION OF THE 571 AMBULATORY VISIT GROUPS

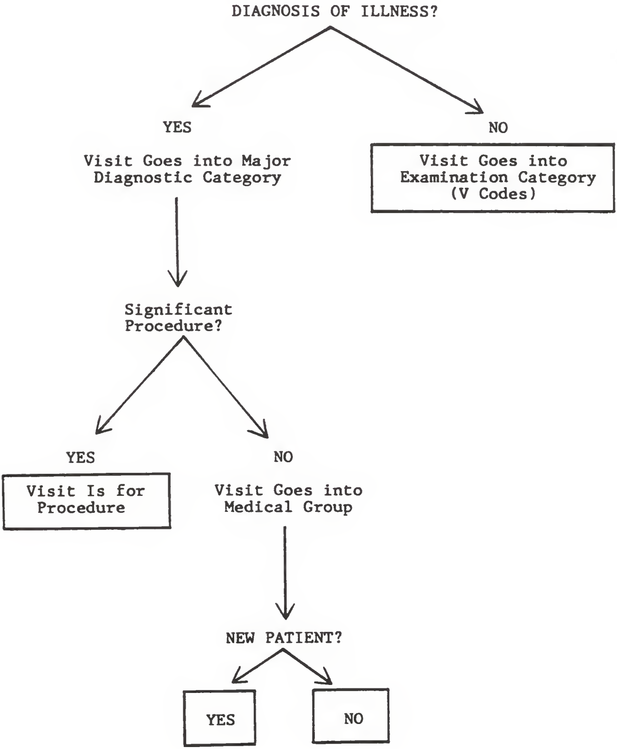

DIAGNOSIS OF ILLNESS?
YES
Visit Goes into Major Diagnostic Category
NO
Visit Goes into Examination Category (V Codes)
Significant Procedure?
YES
Visit Is for Procedure
NO
Visit Goes into Medical Group
NEW PATIENT?
YES
NO

Figure 2 presents the major diagnostic category of disorders of the cardiovascular system as an example. The AVGs shown are preliminary in certain ways which do not affect their construction. For example, they are not numbered consecutively. Rather, as Figure 2 shows, they are identified by their major diagnostic category, in this case 05, and then by a group number within this category. The original version of the DRGs was constructed in a similar manner. The complete English language labels for all 571 ambulatory visit groups as designed and programmed by Yale and reformatted by Brandeis for easier reading is contained in Appendix VII.

In order to evaluate the case mix of an ambulatory practice's data using the AVGs, the following data elements are required:

- ICD-9 primary diagnosis
- CPT-4 code for any procedure performed
- new versus old patient
- age
- sex

The first three variables are used to actually form the final criteria for all but four of the final groups. Age and sex are used to check the internal consistency of the visit data, but determine only about 15 groups. All five of the required variables are available on standard billing systems used by physicians in office-based practice, in HMO's, and in some hospital-based clinics. The old patient/new patient item is obtained by using CPT-4 office medical services codes for the type of the physician visit. These codes distinguish between new and established patients as well as indicating the intensity of the service.

Figure 2

AMBULATORY VISIT GROUPS FOR THE CARDIOVASCULAR SYSTEM

- New Patient Group -

05 : 00 - ISCHEMIC HEART DISEASE
05 : 02 - HEART FAILURE
05 : 03 - THROMBOPHLEBITIS
05 : 04 - ATHEROSCLEROSIS, PERIPHERAL CIRCULATORY DISEASE
05 : 05 - HYPERTENSION
05 : 06 - CONGENITAL HEART & VALVE DISORDERS
05 : 07 - CONDUCTION DISORDERS
05 : 08 - PEDIATRIC CARDIOVASCULAR DISEASE
05 : 09 - OTHER HEART & CIRCULATORY DISORDERS

- Old Patient Groups -

05 : 20 - ISCHEMIC HEART DISEASE WITH CHEST PAIN
05 : 21 - ISCHEMIC HEART DISEASE WITHOUT CHEST PAIN
05 : 22 - HEART FAILURE
05 : 23 - THROMBOPHLEBITIS
05 : 24 - ATHEROSCLEROSIS, PERIPHERAL CIRCULATORY DISEASE
05 : 25 - HYPERTENSION
05 : 26 - CONGENITAL HEART & VALVE DISORDERS
05 : 27 - CONDUCTION DISORDERS
05 : 28 - PEDIATRIC CARDIOVASCULAR DISEASE
05 : 29 - OTHER HEART & CIRCULATORY DISORDERS

- Procedure Groups -

05 : 40 - VEIN STRIPPING & LIGATION, CLASS 1
05 : 41 - VEIN STRIPPING & LIGATION, CLASS 2
05 : 42 - VEIN STRIPPING & LIGATION, CLASS 3
05 : 43 - SCLEROSIS OF VEINS
05 : 44 - CATHETERIZATION-RIGHT HEART
05 : 45 - CATHETERIZATION-LEFT HEART OR FULL
05 : 46 - CATHETERIZATION-SUPERVISION & INTERPRETATION ONLY
05 : 47 - CARDIAC ULTRASOUND, CLASS 1
05 : 48 - CARDIAC ULTRASOUND, CLASS 2
05 : 49 - RADIONUCLIDE STUDIES, CIRCULATORY SYS
05 : 50 - INTRACARDIAC ELECTROPHYSIOLOGIC STUDIES
05 : 51 - NONINVASIVE PERIPHERAL VASCULAR STUDIES
05 : 52 - STRESS TEST
05 : 53 - OTHER VASCULAR PROCEDURES, CIRCULATORY SYS
05 : 54 - EKG MONITORING & SPECIAL STUDIES
05 : 55 - CARDIOVERSION
05 : 56 - CARDIOPULMONARY RESUSCITATION
05 : 57 - OTHER DIAGNOSTIC PROCEDURES, CIRCULATORY SYS

"Portions of this material are based on the
Ambulatory Grouper Program, Copyright (c) 1986,
Yale University, Author: Robert C. Newbold."

Five of the final groups require variables which are not usually available in billing system data. The following is a description of these five groups and the criteria necessary for their formation.

- a visit limited to injections or prescriptions forms a final group in the well adult and well child care major diagnostic category.
- a visit limited to screening or surveillance forms a final group in the same category.
- a visit with a complaint of chest pain is split from other ischemic heart disease, but only for an old patient;
- a patient admitted to the hospital is split from other old patients, but only for malignancies.
- initial visit for chemotherapy forms a final group separate from other chemotherapy.

An example of the first group would be hormone or vitamin injections. Allergy shots are _not_ included here but as a separate injection category under diseases of the respiratory system. The other idiosyncratic groups are self explanatory. No secondary diagnoses are used in any fashion in constructing any of the groups.

While procedures ordered or performed are used to construct the groups, these procedures are limited to those with _direct_ physician time. This time is defined to exclude all pathologists, radiologists, and anesthesiologists and thus only includes the time spent by the treating physician during the face-to-face encounter. This means that no laboratory tests, almost no diagnostic radiation, and no administration of anesthesia will classify a visit into a procedure AVG instead of a regular medical AVG. The only exceptions are therapeutic radiation, which has its own AVG, and certain radiologic procedures where the treating physician actually takes part in the procedure or would be expected to interpret the X-ray.

C. Measures of Resource Use

A measure of resource use is required to determine weights for any case mix-based reimbursement scheme for ambulatory care. Weights are of course also required for any comparison of case mix or product line. It was difficult a priori to decide what the resource use measure should be. Four separate measures were actually constructed and examined.

The first was simply total physician time for the visit. The second was total provider time, which is the sum of the minutes spent with the patients by all providers involved in a visit. The dollar value of these two sets of times was then calculated by attaching dollar amounts to the time spent with patients by the various provider types (staff physicians, residents and interns, nurse practitioners, etc.) based on a mean of actual salaries and fringe benefits obtained from the clinics surveyed.

A third measure was the dollar value of diagnostic tests and procedures. Dollar values were attached to each test and procedure and summed up for each visit. These values were obtained by attaching California Relative Value Units (CRVUs), developed by the California Medical Association, to each test and procedure. The dollar value of each of the four Relative Value Unit Standards (medical, surgical, radiological, and pathological) was then assigned from the 1980 Medicare Directory of Prevailing Charges as administered by Blue Shield of Northern California. The final value for each test or procedure was obtained by multiplying the number of CRVUs for a test or procedure by the dollar value of the procedure group. Finally, the fourth measure was the dollar value of total resource use. This was developed using the sum of the values of time and tests. These four measures apply to primary care. Total resource use in primary care can be best described as total direct costs.

For the oncology data, resource use was measured somewhat differently. The cost of provider time was calculated using the same method as that used for the primary care data. It proved impossible, however, to compute the dollar value of tests and procedures. The major reason for this was that the most substantial oncology procedure, chemotherapy, did not have appropriate relative value units available for the cost of drugs.

Billed charges were accessible for the oncology visits. These charges included the actual charge for the chemotherapy drugs. It was initially thought that these charges could be converted to costs using the hospitals' cost-to-charge ratios. This proved impossible because many expensive specific procedures such as CT scans could not be assigned to specific hospital cost centers and hence a cost-to-charge conversion could not be applied. For these reasons, total billed charges was substituted for the calculated resource use for analysis of the oncology visits.

Physician and total provider time and the costs of this time are comparable between primary care and oncology. For the reasons described in this section of the methodology, however, the total resource use variable in primary care and oncology cannot be compared. While resource use for primary care is limited to direct costs, the billed charges for oncology are reflective of total costs, including overhead. Since the purpose of this grant was not to develop overall weights, this discrepancy was not pursued. In addition, in order to develop overall weights for ambulatory care using resource consumption, other high resource intensive areas such as ambulatory surgery and emergency room visits are required. Data collection in these areas was beyond the scope of this grant.

D. Obtaining the Cost of Diagnostic and Therapeutic Procedures

In order to obtain the cost of diagnostic and therapeutic procedures for visits for primary care, it was necessary to convert them to the same dollar base as provider time. Table 1 presents the relative value units and the process used in converting the actual procedures collected in the study to 1985 dollars. Relative value units for each procedure were obtained from the 1980 California Relative Value Scale. This scale has four specialty areas which are calibrated separately: medical, surgical, pathological, and radiological.

The actual conversion was done by taking 20 common procedures in each of the four specialty areas of calibration and obtaining their cost per relative value unit using Blue Shield Medicare reimbursement at the 75th percentile for 1980. The mean cost for each specialty area in 1980 and 1985 dollars is shown below.

Conversion in 1980 dollars:

Pathological = $ 1.00
Surgical = $ 100.32
Medical = $ 4.11
Radiological = $ 8.43

Conversion in 1985 dollars:

Pathological = $ 1.71
Surgical = $ 171.35
Medical = $ 7.02
Radiological = $ 14.40

The inflation factor for 1985 was obtained from the Consumer Price Index for "other hospital and medical care services" from the Bureau of Labor Statistics.

Not all of the diagnostic and therapeutic procedures were converted to costs. In order to be eligible, the procedure was required to have a cost in excess of the actual direct physician time spent with the patient. For example, administering an electrocardiogram qualified because the physician uses equipment and spends indirect time interpreting the printout from the tracing. Writing a prescription or doing psychological or nutritional counselling with a patient, however, uses only direct physician time and therefore does not qualify as therapeutic procedures in terms of cost. The cost of all prescrition drugs was excluded from the cost of the visit.

All diagnostic and therapeutic procedures which had costs applied in Table 1 have those costs included in the final Yale ambulatory visit groups. However, not all the diagnostic and therapeutic procedures shown in Table 1 form final procedure groups in the Yale AVGs. This is because the AVGs exclude the work of pathologists, radiologists, and anesthesiologists from

Table 1

Method of Calculating Resource Use Cost of Diagnostic and Therapeutic Procedures Ordered or Performed in Ambulatory Care

Diagnostic Procedures

Code	Name of procedure	RVUs	Category	Cost in 1980 dollars	Cost in 1985 dollars
02	Routine lab	13.0	P	$ 13.00	$ 22.23
03	Serology	6.0	P	6.00	10.26
04	Blood chemistry	26.0	P	26.00	44.46
05	ECG	8.0	M	32.88	56.16
06	Culture	18.0	P	18.00	30.78
07	Chest X-ray	2.5	R	21.07	36.00
08	GI	9.1	R	76.71	131.04
09	Other X-rays	4.2	R	35.41	60.48
10	Nuclear medicine	12.75	R	107.48	183.60
11	Scans (bone, brain, abdominal)	41.5	R	350.00	597.60
12	Glucose tolerance	40	P	40.00	68.40
13	Pulmonary function	14.0	M	57.54	98.28
14	Pap smear	12.0	P	12.00	20.52
15	Skin test	10.0	P	10.00	17.10
16	Audiometry	3.0	M	12.33	21.06
17	Tonometry	4.2	M	17.26	29.48
19	Holter monitor	36.0	M	147.96	252.72
20	Complicated blood testing	33.3	P	33.30	56.94
22	Stool test	8.0	P	8.00	13.68
24	EEG, EMG	20.0	M	82.20	140.40
25	Endoscopy	0.4	S	$ 40.13	$ 68.54

Table 1 (continued)

Code	Name of procedure	RVUs	Category	Cost in 1980 dollars	Cost in 1985 dollars
26	Stress testing	30.0	M	$ 123.30	$ 210.60
27	Mammography	18.5	R	155.95	266.40
28	Other X-rays	13.5	R	113.44	194.40
29	Tomogram				
30	Pelvimetry	6.2	R	52.26	89.28
31	Amniocentesis	0.6/100.0	S+P	160.19	273.81
32	Lumbar puncture	0.4/26.0	S+P	66.13	113.00
33	Biopsy in office	0.4	S	40.13	68.54

Therapeutic Procedures

Code	Name of procedure	RVUs	Category	Cost in 1980 dollars	Cost in 1985 dollars
02	Immunization	2.2	M	$ 9.04	$ 15.44
03	Other injections	2.0	M	8.22	14.04
04	Dressing: apply/remove	0.1	S	10.03	17.13
06	Joint injection/ anesthetization	0.25	S	25.08	42.84
13	Excision of polyp, wart, incision and drainage	0.2	S	20.06	34.27
17	IV (intravenous) therapy: rehydration	0.15	S	15.05	25.70
18	Catheterization (bloods from Hickman catheter)	0.15	S	15.05	25.70
19	Reduction, open	3.4	S	341.09	582.59
20	Reduction, closed	4.4	S	441.41	753.94
21	Cast, splint	0.4	S	$ 40.13	$ 68.54

their definition of a procedure performed. For this reason, all laboratory tests and almost all radiological procedures, except those interpreted by the attending physician, are prevented from splitting into separate groups. Furthermore, those procedures which are included form separate groups only under certain circumstances. For example, chest X-rays form a separate procedure group only when there are three or more views and only when the diagnosis for the visit falls into the major diagnostic category of respiratory illness.

Table 2 converts all procedures which meet the Yale requirements to CPT-4 codes. It will immediately be noted that some procedures which split groups in the AVGs - namely immunizations and other injections as the only reason for the visit -- have no costs beyond provider time and therefore are not shown in Table 2.

Table 2

Conversion of Primary Care Procedures Collected by Brandeis Ambulatory Care Project into CPT-4 Codes

DIAGNOSTIC PROCEDURES

Description	Ambulatory Care Project code	CPT-4 code
Electrocardiogram	05	93000
Chest X-ray	07	71110
GI series (barium meal)	08	74241
Other X-rays (simple - knee)	09	73564
Nuclear medicine except scans (cardiac ultrasound)	10	93300
Scans (brain)	11	70450
Pulmonary function test (spirometry)	13	94010
Audiometry(1)	16	92557
Tonometry	17	92100
Holter monitor (phonocardiogram)	19	93201
Electroencephalogram	24	95819
Endoscopy (Nasopharyngoscopy)	25	92511
"Stress testing"	26	93015
Other X-ray - complicated	28	72110
Amniocentesis	31	59000
Lumbar puncture	32	62270
Biopsy (skin)	33	11100
Bone marrow aspiration	35	85095
Thoracentesis	36	32000
Paracentesis	37	49080
"Aspiration" (joint)(1)	41	20605

THERAPEUTIC PROCEDURES

Description	Ambulatory Care Project code	CPT-4 code
Immunization	02	90720
Other injections	03	90782
Apply or remove dressing (burn)	04	16020
Joint injection (knee)	06	27370
Excision of polyp or wart or incision and drainage	13	17100
Rehydration, IV therapy(2)	17	36430
Open reduction (radial or ulnar, without manipulation)	19	25560
Closed reduction (radius, with manipulation)	20	25505
Cast or splint (short arm)	21	29125

(1) Midrange taken
(2) Coded as transfusion of blood components

FINDINGS

This section of this final report discusses four major types of findings. The first set of findings are those related to differences in case mix, resource use and patient characteristics for visits in various types of clinic settings. These differences have important implications for any case mix reimbursement scheme such as the Yale AVGs, which is based on only a few easily obtainable variables.

The second set of findings is related to the ultimate weighting scheme which will indicate variations in resource use. This set of findings discusses three alternative resource use measurements and indicates correlations among them.

The third set of findings presents the Yale ambulatory visit groups applied to the Brandeis data. This is done for adult medical care, pediatrics, obstetrics-gynecology, medical oncology, and therapeutic radiology.

The fourth set of findings is based on developing an alternative to the Yale AVGs based on data collected by the Brandeis project for a high technology OPD specialty.

I. Differences in Ambulatory Setting

In general, adult primary care visits to hospital OPDs appear to differ substantially from visits to neighborhood health centers in diagnosis and resource use. Visits to public as opposed to voluntary OPDs do not differ much on diagnosis and resource use but do differ in more subtle ways.

A. Hospital OPDs Compared to Community Health Centers

Resource use is substantially higher for selected adult primary care diagnoses in hospitals compared to community health centers (CHCs). Table 3 shows this difference for three common diagnoses. Since all CHC data came from Boston facilities, the comparisons in Table 3 here are only made with Boston OPDs.

Hypertension visits required about 35 percent more provider time and 12 percent more total resources in the OPDs compared to the community health centers. Interestingly, physical examination used substantially less total resources in the OPD, $28.98 compared to $39.42 in the CHC. Total provider time use for physical examinations, however, was more intensive in the OPD than in the CHC with visits lasting almost 10 minutes longer. Chronic airway obstruction visits, on the other hand, were substantially more resource intensive in the OPD.

Table 4 provides a summary of community health centers compared to hospital OPDs by resource use by type of provider. For overall resource use for all visits combined, neighborhood health centers had a mean resource use of $26.99 per visit, compared to $37.77 in community health centers. This difference is significant at the .01 level. Physician time, provider time, and the total value of tests are all significantly lower in the community health centers.

Table 3

Total Provider Time and Resource Costs for Boston Outpatient Departments and Neighborhood Health Centers

	Total provider time in minutes	Total resource cost in dollars
Hypertension		
OPD	25.5	$ 26.74
CHC	18.9	23.74
Total	22.3	25.28
Physical exam		
OPD	37.5	28.98
CHC	28.9	39.42
Total	30.3	37.71
Chronic airway obstruction		
OPD	30.0	34.30
CHC	18.6	25.34
Total	25.1	$ 30.46

Table 4

A Comparison of Visits to Hospital OPDs and Neighborhood Health Centers on Four Measures of Resource Use

	All hospital OPD visits	Neighborhood health center visits
Time in minutes(1)		
Staff physician	25.7	20.1
Resident	28.6	19.8
Nurse practitioner	29.4	21.0
Other	36.5	19.9
Total	27.3	20.2**
Dollar value of time(2)		
Staff physician	8.87	$ 7.09
Resident	5.82	4.36
Nurse practitioner	5.53	3.92
Other	8.21	3.58
Total	7.48	$ 6.24**
Dollar value of tests(3)		
Staff physician	$ 28.88	$ 21.80
Resident	31.33	17.70
Nurse practitioner	20.87	15.50
Other	9.70	20.73
Total	$ 30.29	$ 20.75**
Dollar value of resource use(4)		
Staff physician	$ 37.75	$ 28.89
Resident	42.18	22.06
Nurse practitioner	26.40	19.42
Other	17.91	24.31
Total	$ 37.77	$ 26.99**
Number of cases	5,296	2,235

* Differences between public OPDs and private OPDs significant at the .01 level

** Differences between private OPDs and neighborhood health centers significant at the .01 level.

B. Public Hospitals Compared to Voluntary Hospitals

There was surprisingly little difference in resource use between public and voluntary OPDs for adult primary care. If anything, the voluntary OPDs were slightly more resource intensive for a visit than were the public OPDs. None of these differences were statistically significant, however. Table 5 shows the same comparison for public versus voluntary hospital clinics which was previously done for all hospital clinics compared to OPDs. Public OPD visits used less staff physician and resident time and more nurse practitioner and other provider time than voluntary hospitals.

When individual diagnoses are considered, the difference between the two sites is more pronounced. Hypertension and arthritis are more costly to treat in public hospitals than in voluntary OPDs. Most of this cost difference can be attributed to heavy use of diagnostic tests and procedures in the public setting. Diabetes, medical exam and neuroses are less expensive to treat in the public setting, again largely due to differences in utilization of tests.

While the public OPDs do not seem to be any more resource intensive than the voluntary hospital OPDs, they do appear to treat somewhat sicker and more complex patients. Table 6 indicates that the public OPD pattients are more apt to have multiple diagnoses. The mean number of secondary diagnoses for a visit was .93 in the voluntary hospitals compared to 1.12 in the public hospital OPDs. Nearly 30 percent of patients in the public OPDs had two or more secondary diagnoses, compared to twenty-two percent in the voluntary OPDs.

Table 5

A Comparison of Visits to Public and Voluntary Hospital OPDs on Four Measures of Resource Use

	Public hospital OPD visits	Voluntary Hospital OPD visits
Time in minutes		
Staff physician	24.8	26.9
Resident	25.5	32.5
Nurse practitioner	31.0	27.5
Other	41.0	30.9
Total	26.4	28.4
Dollar value of time		
Staff physician	$ 8.83	$ 8.93
Resident	4.71	7.20
Nurse practitioner	5.78	5.22
Other	9.72	6.35
Total	$ 6.97	$ 8.12
Dollar value of tests		
Staff physician	$ 27.45	$ 30.64
Resident	36.03	25.53
Nurse practitioner	22.32	19.08
Other	2.79	18.24
Total	$ 30.28	$ 30.30
Dollar value of resource use		
Staff physician	$ 36.28	$ 39.57
Resident	41.74	42.73
Nurse practitioner	28.10	24.30
Other	12.51	24.59
Total	$ 37.25	$ 38.42
Number of cases	2,927	2,369

Table 6

Number of Secondary Diagnoses in Adult Medicine Clinic Patients Visiting Public and Voluntary Adult Medicine Clinics

Number of secondary diagnoses	Visits in public OPD		Visits in voluntary OPD	
	Number	Percent	Number	Percent
None	558	33.3%	498	38.8%
One	618	36.9	504	39.3
Two	308	18.4	182	14.2
Three	130	7.8	62	4.8
Four	62	3.7	38	3.0
Total visits	1,676	100.0%	1,284	100.0%
Mean number of secondary diagnoses	1.12^{***}		0.93^{***}	

*** $p < .001$

Based on the provider's own evaluation of the urgency of the visit, Table 7 shows that only two percent of the public OPD visits had no urgency, compared to 21 percent of the visits to voluntary OPDs. The measure of urgency was not taken from NAMCS, but from an adaptation of NAMCS done in 1977-1979 by the University of Southern California Medical School (Mendenhall, 1978a, 1978b).

Most importantly, patients in adult medicine seen in public hospital OPDs tended to have more social problems, communication difficulties and high risk factors than those seen in the voluntary OPDs. Since this finding has such policy importance, it has been assigned its own section in this final report.

C. Patients with Social Problems

It has long been argued, but usually anecdotally, that hospital OPD patients have substantial non-medical problems that make them more difficult to deal with than other types of clinic patients or than private patients. This section addresses this issue through actual data analysis.

Patients who visit the adult primary care clinics of hospitals, especially public hospitals, suffer from more social problems, communication difficulties such as need for an interpreter, and other factors prolonging the length of the visit than do patients at neighborhood health centers. Patients of physicians in an office-based setting would be expected to be the lowest of all and thus be least provider time intensive.

Table 8 contrasts the social problems found in public OPDs, private OPDs, and neighborhood health centers. The prevalence of social problems is similar

Table 7

Urgency of Care Needed by Patients Visiting Public and Voluntary Hospital Adult Medicine Clinics

Urgency of care required	Visits in Public OPD		Visits in Voluntary OPD	
	Number	Percent	Number	Percent
None	30	2.0%	251	20.5%
Could Have Been Delayed	584	39.7	312	25.4
Needed to See Today	801	54.4	596	48.6
Should Have Been Seen Sooner	48	3.3	64	5.2
Emergency	9	0.6	3	0.2
Total visits	1,472	100.0%	1,226	100.0%
Missing values	204		58	
Mean value (No urgency = 1, Emergency = 5)	2.61^{***}		2.39	

*** $p < .001$

Table 8

Most Common Social Problems for All Adult Visits and for Adult Primary Care Visits in Public and Private Hospital OPDs

	Percent of visits with a social problem		
	Primary care clinics in:		
Social problem	Public OPDs	Private OPDs	Neighborhood health centers
Anxiety	19.3%	20.8%	14.8%
Situational problem	15.7	14.6	8.8
Needs an interpreter	13.4	14.1	10.1
Depression	11.6	15.0	10.6
Minor psychological	6.0	7.9	5.5
Speaks English with difficulty	10.6	5.4	2.1
Financial problem	7.5	6.7	4.7
Alcoholism	6.3	4.6	4.5
Medical non-compliance	5.3	2.6	3.8
Severe physical disability	4.7	4.2	2.6
Major psychological	2.8	2.2	3.5
Ex-alcoholic or addict	2.4	2.3	2.1
Communication problem	2.1	2.5	1.0
Drug abuse	1.8	1.5	1.4
Housing/homeless	1.8	1.3	1.1
Mental retardation	0.7	1.5	1.6
Number of visits	2,134	2,389	2,235
Mean number of problems per visit	1.12	1.07	.78

Note: The social problems in this table were obtained from a check-list of social problems appearing on the actual questionnaire. In addition, any patient having a primary or secondary diagnosis which appeared on the check-list was counted as having a social problem even if this was not also specified on the check-list.

in the public and private OPDs except that patients in the public OPDs are more apt to have difficulty with English, to be alcoholic, and to be medically non-compliant. Patients in OPDs have substantially more social problems than those in neighborhood health centers.

Table 9 presents in more detail a profile of the socio-demographic characteristics which may make a patient more difficult to treat. As measured in this survey, over half of the patients in hospital OPDs have a social problem. Patients seen in the geriatric and walk-in clinics had fewer social problems than those seen in the regular adult primary care clinics, where the proportion approached two-thirds. If certain economic and demographic characteristics are included, such as inability to pay the bill, minority race, or being frail-elderly, fully 93.5 percent of the visits to public OPDs are by patients who are more likely to possess an added complication that could require more resources to treat. This compares to 81.2 percent in private OPDs. The corresponding figure for neighborhood health centers is only 70.3 percent. If a figure could be obtained for private practice in the United States, it would undoubtedly be lower still. Two Canadian studies indicate substantial differentials. (Rudd and Carrier, 1978; Rudnick et al., 1976).

Even if social problems occur in high proportions among the population using OPDs, does this necessarily mean that patients with these problems use more resources? This is an important issue since the presence of large numbers of patients with social problems by itself is not a justification for greater costs or reimbursement.

Table 9

Selected Characteristics of Visits to OPDs and Neighborhood Health Centers

Measurement of characteristic	Percent of visits with characteristic		
	Public OPDs	Private OPDs	Neighborhood health centers
Social problems			
Has at least one problem	63.7%	60.0%	48.5%
Has at least one major problem(1)	18.0	16.0	13.4
Mean number of social problems per visit	1.12	1.07	.78
Mean number of social problems for those visits with at least one	1.76	1.78	1.61
Socio-economic characteristics			
Minority(2)	67.9	42.0	28.2
No way to pay bill(3)	20.1	7.3	16.2
At least 75 years old	14.2	15.7	11.9
All characteristics combined	93.5	81.2	70.3

(1) Major social problems consist of alcoholism, drug abuse, ex-alcoholic or addict, communication problem, housing/homeless, major psychological problem, or severe physical disability.

(2) Black, Oriental, or Hispanic.

(3) Includes part pay as well as no pay.

In fact, patients with social problems appear to use about 20 percent more provider time overall than patients without. There were marked differences among clinics, types of providers, and individual diagnostic categories but in almost all cases, the general finding held true. Table 10 shows the provider time used by patients with and without social problems for the top ten diagnoses. Patients with a primary diagnosis of neurosis (usually anxiety or depression) had a social problem by definition; for all other primary diagnoses except symptomatic heart disease, patients with a social problem used more time than patients without.

It will be recalled from Table 5 that patients visiting public hospitals used slightly less overall provider time than patients visiting voluntary hospitals. Physician time was somewhat lower and nurse and other provider time somewhat higher in the public OPDs. The other providers were mainly social workers nd interpreters. The conclusion to be drawn from the public hospital OPDs serving more patients with social problems in slightly less time may be either that they are more efficient or that they are spending less time than actually warranted with these patients.

Table 11 presents more detailed data on provider time for patients with and without a social problem for all OPD visits. Visits to social workers, psychologists, and other non-medical practitioners have been eliminated without changing the overall results substantially. For all diagnoses combined, patients with social problems use 21 percent more provider time. Nurses are the most apt to spend more time with someone with a social problem and residents the least likely.

Table 10

Provider Time Use, With and Without a Social Problem, by Diagnosis, All Primary Care Clinics

Top ten diagnoses	Percent with social problem	Unweighted provider time in minutes	
		With a social problem	Without a social problem
Hypertension	55.7 %	25.7*	22.5*
Diabetes	5559.1	29.7*	24.5*
Neuroses	100.0	33.6	--
Osteoarthritis	52.9	28.6	25.3
Chronic ischemic heart disease	52.3	29.9	25.6
Symptomatic heart disease	57.1	28.8	29.8
Urinary-tract infection	44.3	31.4	25.3
Asthma	56.2	28.7*	21.2*
Medical examination	43.4	26.9	19.2
Chronic obstructive pulmonary disease	64.8	30.8	29.9
All patients, all diagnoses	60.0 %	29.4*	24.0*

Based on 5,296 total cases

*Differences significant at the .01 level.

Table 11

Provider Time Use, With and Without a Social Problem, by Diagnosis, All OPDs

Diagnosis	Salaried physician minutes		Resident minutes		Nurse minutes		Mean total (unweighted) minutes	
	With	Without	With	Without	With	Without	With	Without
All diagnoses	27.8*	23.2*	29.1*	25.2*	33.1*	22.0*	29.0*	24.0*
Hypertension	24.2*	21.2*	25.4	24.7	30.4*	21.3*	25.7*	22.6*
Diabetes	29.0*	22.3*	29.6	27.0	30.6*	27.1*	29.6*	24.5*
Osteoarthritis	27.4	25.2	29.9	27.0	38.0	18.0	28.7	25.5

Based on 5,085 total cases

*Differences for patients with and without a social problem are significant at the .01 level.

So far, the measure of resource use examined has been provider time of various types in order to examine the possibility that at least part of the excess personnel cost found per visit in OPDs could be due to social problems. The possibility remains that tests substitute for time and that the total resources used are no greater for patients with a social problem than those without.

This possibility was examined in Table 12 by assigning a dollar value, in 1980 dollars, to weighted provider time and combining this with the 1980 value of tests ordered or performed at this visit. The value of provider time is based on mean weighted minutes, standardized by the value of a salaried physician's time at unity. This technique reduces the excess provider time used to 16 percent, mostly by discounting the nurse time. Patients with a social problem use 13 percent more tests. Their overall resource use is 14 percent more than patients without social problems. In other words, as the following ratios show, tests do not substitute for time:

Cost of weighted provider time	1.16
Cost of tests	1.13
Total resource use	1.14

Patients who have social problems are frequently the patients who are considered to be more complex to treat, using a global physician evaluation. As Table 13 shows, less than half of the patients who providers felt had an overall set of problems requiring minimal care had a social problem compared

Table 12

Mean Value of Resource Use by Patients With and Without Social Problems

Diagnosis	Value of weighted provider time		Test value		Resource use	
	With	Without	With	Without	With	Without
All diagnoses	$ 7.84*	$ 6.74*	$ 29.29*	$ 25.93*	$ 37.13*	$ 32.67*
Hypertension	6.89*	6.26*	26.98	24.28	33.87	30.54
Diabetes	7.62*	6.55*	30.31	29.21	37.93	35.76
Osteoarthritis	8.30	7.55	35.91	26.33	44.21	33.88

*Significant at the .01 level.

Table 13

Percent of Visits with Social Problems, by Complexity Levels

Complexity level(1)	Number of cases	Percent of visits with a social problem
Minimal	631	45.3 %
Brief	1,047	52.9
Limited	2,016	62.3
Extended	840	68.8
Comprehensive	445	66.1
Total	4,979	59.1

(1) Adapted from USC-Mendenhall, based upon American Medical Association CPT codes.

to two-thirds of those who needed extended or comprehensive care. Presence of a social problem is also positively associated with the number of a patient's secondary diagnoses. As shown in Table 14, less than half of the patients with no secondary diagnosis had a social problem compared with almost 80 percent of the patients with four secondary diagnoses.

Table 14

Percent of Visits with Social Problems by Number of Secondary Diagnoses

Number of secondary diagnoses	Number of cases	Percent of cases with a social problem
None	1,591	46.7%
One	1,731	57.5
Two	957	64.6
Three	568	71.7
Four	449	78.8
Total	5,296	59.1%

D. Summary of Differences in Ambulatory Setting

This first section has dealt with issues which may affect the resource consumption involved in a visit which appears at first glance to be for a given diagnosis and thus comparable across settings. The assumption is that if a reimbursement scheme is developed using ambulatory visit groups, some factor might be added to reimburse a hospital OPD visit more heavily than that of a neighborhood center and, possibly, a public hospital visit more highly than that of a voluntary hospital.

None of the variables discussed in these first three sections are incorporated into the Yale AVG scheme. Rather, the Yale scheme has been kept simple in order for it to be applied to elements currently existing in data sets. Under these circumstances, variables of vital concern to hospital OPDs, such as secondary diagnoses, urgency of care, and presence of social problems, communication problems, and other high risk factors among their patients, could be incorporated in a reimbursement system.

An equally important issue for hospital OPDs is the relationship of the various measures of resource use which could be used to weight the ambulatory visit groups, either for case mix analysis or for actual reimbursement. This is addressed in the next section of this report.

II. Measures of Resource Use

Physician time is not a sufficient measure of resource use for ambulatory care visits in a clinic setting. A substantial proportion of visits to both primary care and specialty clinics are to non-physicians. The percent of clinic visits without physician time vary considerably by type of clinic:

Adult medicine	15.7%
Pediatrics	22.8
Medical oncology	29.6
Obstetrics-gynecology	49.1
Radiation therapy	50.8

The most common non-physician provider in hospital clinics is a nurse practitioner, but at least eight other types of non-physician paraprofessional providers were identified as well.

One alternative measure of resource use would simply be all provider time used for the visit. An even more comprehensive measure would incorporate the value of tests ordered or performed. The first portion of this section discusses the correlations among these diverse measures.

A. Correlations among Resource Use Measures for Primary Care

For the primary care data, provider time was monotized and tests and procedures were assigned dollar values according to a technique described previously. Table 15 displays the correlation among physician time, total provider time, and total resource use for the leading AVGs for adult general medicine. The correlations between provider time and total resource use are all positive. The correlation is only .31 overall, however, and it is as low as .09 for anxiety and depression in an old patient and .10 for diabetes in an old patient. Clearly a case mix scheme which attempts to develop a resource use weight for each AVG will look extremely different if provider time is used than if total resource consumption is the basis of the weighting. This point needs to be emphasized.

As a resource measure for case mix based reimbursement, using physician time alone does not appear feasible for hospital clinics. Physician time correlates just as poorly as total provider time with total resource use. As previously noted, less than 85 percent of the visits for adult primary care involved any physician time at all. Moreover, primary care has a higher percentage of visits to physicians than many other specialties. For example, in obstetrics-gynecology and radiation therapy clinics, fully half of the patients did not see a physician. In office-based practice, the highest proportion of visits where the physician does not see the patient is to

Table 15

Correlation Among Three Dependent Variables for Adult Medicine Clinics

AVG	Group	Correlation between physician and total provider time(1)	Correlation between physician time and total resource use(1)	Correlation between provider ti and total resource use
0525	Hypertension, old patient	.79	.28	.23
1021	Diabetes, old patient	.77	.10	.10
0505	Hypertension, new patient	.84	.56	.56
1923	Anxiety or depression, old patient	.79	.22	.09
0823	Degenerative joint disease, old patient	.88	.32	.23
0521	Ischemic heart disease without chest pain, old patient	.83	.31	.26
2309	Injections and medication	.74	.66	.63
0332	Asthma, old patient	.77	.28	.17
2300	General medical examination	.82	.15	.16
2302	Screening, surveillance, and symptoms	.84	.48	.48
0882	X-rays, musculoskeletal system	.82	.24	.25
0329	Chronic obstructive pulmonary disease, old patient	.86	.14	.15
	All visits	.83	.32	.31

(1) Based on 6,346 cases having physician time.

(2) Based on 7,531 cases having both total provider time and total resource use.

pediatric allergists (NAMCS, unpublished data). Even for ambulatory surgery, not all procedures are performed by a physician, as is the case in hospital-based dental clinics.

B. For Oncology

For the oncology data, the relationship among the three measures of resource use was examined in two ways: simple correlations and a non-parametric ranking test (the Kendall coefficient of concordance). The results of these two techniques are reported to conclude this section on correlations.

The correlations among the three dependent variables are moderate at best, except for that between physician time and total provider time. This correlation (.63) is artificially high since only those 1,989 cases with at least some physician time were used in the comparison. This correlation should not be interpreted to mean that physician time can be used as a proxy for provider time, particularly for the one third of the visits which do not see a physician *and which show a substantially different provider distribution* on provider time than the visits which were used to construct this correlation. In view of the pressure that may very well ensue to use the second generation of ambulatory visit groups as a mechanism for reimbursement, the correlations in Table 16 might well be studied carefully. Although the previous tables have indicated that use of any of the three dependent variables will give a roughly similar tightness of fit for many of the groups, Table 16 indicates that *which variable is used has a profound effect on the resource use attributed to some groups*.

Table 16

Correlations Among the Three Dependent Variables

AVG number	Group	Correlation between physician time and provider time (1)	Correlation between physician time and total charges (1)	Correlation between provider time and total charges (
1	Radiation therapy set-up	.83	.24	.25
2	Radiation therapy clinical management	.83	.15	.26
4	Bone marrow	.90	.12	.25
5	Blood products	.11	.02	.30
6	Lumbar and ventricular puncture	.91	.52	.47
8	Chemotherapy, simple	.73	.25	.33
9	Chemotherapy, complex	.49	.14	.35
10	Chemotherapy - very complex	.40	.31	.28
12	New patient	.96	.22	.25
13	Admit to hospital	.16	-.06	.12
14	Follow-up	.77	.13	.27
Total		.63	.21	.43

(1) Based on 1,989 cases having both physician and provider time.

(2) Based on 3,051 cases having both provider time and total changes.

Table 16

Correlations Among the Three Dependent Variables

AVG number	Group	Correlation between physician time and provider time(1)	Correlation between physician time and total charges(1)	Correlation between provider time and total charges(
1	Radiation therapy set-up	.83	.24	.25
2	Radiation therapy clinical management	.83	.15	.26
4	Bone marrow	.90	.12	.25
5	Blood products	.11	.02	.30
6	Lumbar and ventricular puncture	.91	.52	.47
8	Chemotherapy, simple	.73	.25	.33
9	Chemotherapy, complex	.49	.14	.35
10	Chemotherapy - very complex	.40	.31	.28
12	New patient	.96	.22	.25
13	Admit to hospital	.16	-.06	.12
14	Follow-up	.77	.13	.27
Total		.63	.21	.43

(1) Based on 1,989 cases having both physician and provider time.

(2) Based on 3,051 cases having both provider time and total changes.

Table 17 summarizes the earlier information on the oncology hierarchies by physician time, provider time and total charges. A non-parametric statistical technique was modified to test if these apparent differences in ranking were statistically significant. The ranks shown in Table 17 were treated as scores and for each AVG were ranked across these scores. For example, AVG 12, new patient, was the most resource intensive for physician time, was third most intensive for provider time, but was only eighth most intensive for total charges. These ranks were converted to 1, 2, and 3, and this process was repeated for the remaining AVGs. The results from a three-way and from three pairwise comparisons of these ranked scores showed that the rankings of physician time, provider time, and total charges were all highly significantly different from one another ($p < .00001$).

C. Summary of Correlations among Resource Use Measures

Although the AVGs were not developed specifically for reimbursement purposes, there is some speculation that, like the DRGs, they may be used for this purpose. In a reimbursement system, the relative weights that are attached to the AVGs would be an integral factor in determining the final price per AVG. The data presented in this section lead to the inescapable conclusion that because the ranking are so different depending on which dependent variables is used, relative weights would also be greatly different.

III. Hospital Clinic Data Used to Evaluate the Yale Ambulatory Visit Groups

The remainder of this report uses total resource use as the dependent variable in evaluating the Yale AVGs. Actual weights have not been

Table 17

Rank Order of Physician Time, Total Provider Time and Total Charges by AVG

AVG number	Description	Rank of physician time	Rank of total provider time	Rank of total charg
12	New patient	1	3	8
4	Bone marrow	2	4	3
6	Lumbar and ventricular puncture	3	7	6
1	Radiation therapy set-up	4	6	4
13	Admit to hospital	5	2	5
10	Chemotherapy	6	1	2
14	Follow-up	7	9	10
8	Chemotherapy, simple	8	11	9
9	Chemotherapy, complex	9	8	7
5	Blood products	10	5	1
2	Radiation therapy clinical management	11	10	11

calculated since the Brandeis data do not span the entire set of AVGs. Ambulatory surgery and emergency room data would be necessary for a proper, comprehensive calculation.

A. The AVGs in Primary Care

For primary care at least, the Yale Ambulatory Visit Groups have considerable face validity. Tables 18, 19 and 20 show the resource use for the 12 most common AVGs in adult medicine, pediatrics and obstetrics-gynecology. In adult medicine the most common AVGs account for 48 percent of the visits. In pediatrics they account for 87.5 percent of the visits and in obstetrics-gynecology include 85.7 percent of the visits. Adult medicine spans the largest proportion of AVGs for at least two reasons: One is that adults are more apt to have chronic illnesses than are children, whose visits are concentrated into well child care. The other is, of course, that obstetrics-gynecology is almost totally relegated in the AVG system to two major diagnostic categories.

The most expensive common adult medicine AVG was X-rays of the musculoskeletal system with a mean value of $79.23. Counting all AVGs with at least five cases falling into them using the Brandeis data, the most resource intensive AVGs were all in the subspecialty of cardiology:

EKG monitoring	$ 195.20
Cardiac ultrasound	$ 166.57
Cardiac stress testing	$ 145.05

The least expensive AVGs were all pediatric:

Otitis media, old patient	$ 5.79
ENT trauma, old patient	$ 4.19
ENT trauma, new patient	$ 3.43

Table 18

Adult Medicine Clinics

Resource Use

AVG	Description	Number of cases	Mean dollar value of resource use	Standard deviation	Coefficient of variation
0525	Hypertension, old patient	1,255	$ 26.76	38.1	1.42
1021	Diabetes, old patient	530	38.14	41.7	1.09
0505	Hypertension, new patient	266	43.38	42.3	.98
1923	Anxiety or depression, old patient	255	26.66	48.3	1.81
0823	Degnerative joint disease, old patient	248	29.47	40.5	1.37
0521	Ischemic heart disease without chest pain, old patient	182	30.38	33.2	1.09
2309	Injections and medication	165	12.87	20.4	1.59
0332	Asthma, old patient	157	20.63	24.8	1.20
2300	General medical examination	152	36.91	45.0	1.22
2302	Screening, surveillance, and symptoms	146	34.47	37.8	1.10
0882	X-rays, musculoskeletal system	142	79.23	39.5	.50
0329	Chronic obstructive pulmonary disease, old patient	119	30.08	65.7	2.18
	All visits	7,531	$ 34.58	48.46	1.40

Table 19

Pediatrics Clinics

Resource Use

AVG	Description	Number of cases	Mean dollar value of resource use	Standard deviation	Coefficient of variation
2301	Well child care	629	$ 22.63	24.8	1.10
0323	Otitis media, old patient	116	5.87	7.2	1.23
2300	General medical exam	104	26.59	15.0	.56
1820	Viral disease, old patient	72	10.70	11.6	1.08
0325	Upper respiratory infection, old patient	63	7.96	11.3	1.42
0924	Dermatitis and eczema, old patient	56	8.88	12.7	1.43
0324	Pharyngitis, old patient	52	18.34	7.8	.43
0922	Skin infection, old patient	48	9.79	13.3	1.36
0622	Gastroenteritis, old patient	40	10.09	10.4	1.03
0364	Audiometry, simple procedure	37	31.07	13.5	.43
2302	Screening, surveillance and symptoms	37	15.76	24.3	1.54
2309	Injections and medication	34	22.26	61.0	2.74
	All visits	1,909	$ 16.80	23.2	1.38

Table 20

Ob-Gyn Clinics

Resource Use

AVG	Description	Number of cases	Mean dollar value of resource use	Standard deviation	Coefficient of variation
1420	Prenatal care, old patient	183	$ 22.47	30.5	1.36
1424	Contraception, old patient	146	20.52	18.3	.89
1400	Initial visit for pregnancy	61	40.40	43.4	1.07
1404	Contraception, new patient	50	36.60	22.9	.63
1321	Pelvic inflammatory disease, old patient	39	26.32	19.3	.73
2309	Injections and medication	18	17.46	18.2	1.04
1324	Menstrual disorders, old patient	17	18.31	12.3	.67
1326	Gynecological examination, old patient	17	32.59	20.6	.63
1301	Pelvic inflammatory disease, new patient	16	31.85	16.3	.51
1422	Normal pregnancy, postpartum, old patient	15	21.73	14.4	.66
0000	Ungrouped	14	29.75	50.0	1.68
1304	Hormonal and menstrual disease	11	56.42	40.7	.72
	All visits	705	$ 27.68	30.64	1.11

In the pediatric clinic the audiometry AVG was the most expensive common AVG at $31.07. This group also had a low coefficient of variation (.43). Hormonal and menstrual disease was the most costly ob-gyn AVG, costing $56.42. The least expensive ob-gyn AVG was injections and medication, costing $17.46.

B. The Oncology AVGs

Oncology related diagnoses form one of the major diagnostic categories in the Yale AVG system. The fourteen oncology AVGs are shown schematically in Figure 3. Unlike many of the other AVGs which are diagnosis based, the oncology groups are mainly related to procedures performed during the visit. When more than one significant procedure was performed in oncology, Yale assigned priorities as follows: Groups 1, 7, 10, 9, 3, 2, 8, 11, 6, 4 and 5. The group numbers are different in the final overall AVG scheme but the sequence is the same.

Table 21 shows the mean charges, standard deviation and coefficient of variation for each of the Yale oncology AVGs that could be formed using the Brandeis data. The table is ranked by resource intensity. It should be remembered that total billed charges is the measure of resource use for the oncology AVGs.

Transfusion of blood products is the most expensive AVG. Even the least expensive oncology -- simple chemotherapy, routine follow-up, and radiation therapy administration are highly expensive. The AVG with the lowest coefficient of variation and hence the least variation in resource use was AVG 5, transfusion of blood products. The AVG with the most variation was AVG 8, having a coefficient of variation of .88.

Figure 3

Ambulatory Visit Groups for Malignant Neoplasms and Myeloproliferative Diseases

"Portions of this material are based on the Ambulatory Grouper Program, Copyright (c) 1986, Yale University, Author: Robert C. Newbold."

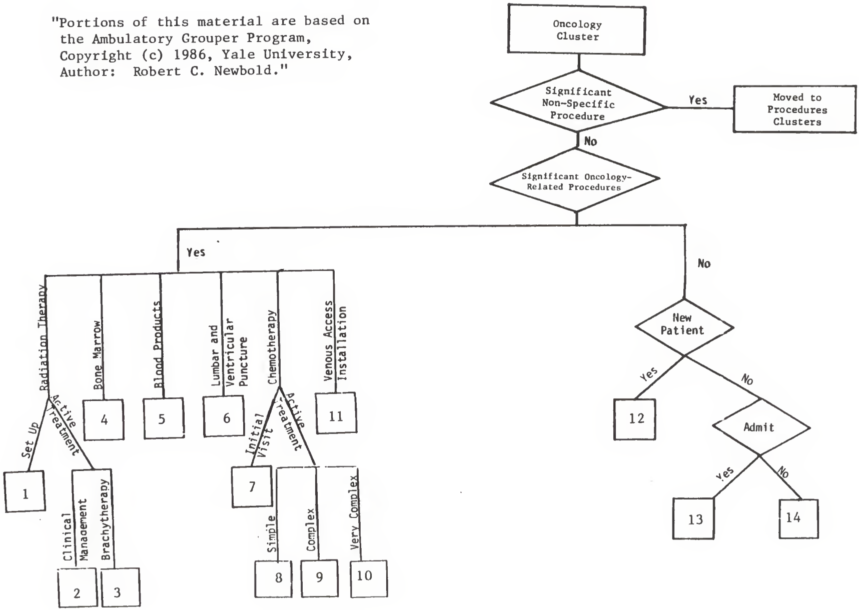


Table 21

Total Charges by AVG

AVG number	Description	Mean total charge	Standard deviation	Coefficient of variation
5	Blood products	$ 761.21	$ 281.79	.37
10	Chemotherapy - very complex	625.66	352.40	.56
4	Bone marrow	592.86	251.29	.42
1	Radiation therapy planning	477.74	186.56	.39
13	Admit to hospital	415.17	237.11	.57
6	Lumbar and ventricular puncture	393.44	202.67	.52
9	Chemotherapy, complex	362.10	239.97	.66
12	New patient	346.13	267.91	.77
8	Chemotherapy, simple	283.28	248.75	.88
14	Follow-up	268.62	221.04	.83
2	Radiation therapy administration	106.63	62.80	.59
Total		$ 275.69	$ 252.20	.91

IV. The Brandeis Variation on Medical Oncology Ambulatory Visit Groups

Brandeis had considerable input into the formation of the Yale ambulatory visit groups for oncology. This included Brandeis staff attending three meetings at Yale, having a Brandeis medical oncology consultant and a cancer center administrator comment on the preliminary groups, and pre-testing the final groups. Because of the relative tightness of the final groups, Brandeis was unable to improve substantially among them without creating considerably more than the original 14 groups.

The remainder of this section presents the oncology groups developed by Brandeis. These groups are based both on the procedure performed and, in many cases, the specific diagnosis. The Brandeis groups are also more detailed in the their approach to radiation therapy visits.

Brandeis developed groups for both radiation treatment visits as well as visits for planning the radiation therapy process. Figure 4 shows schematic representation of the medical oncology groups along with the mean charge and number of visits for the largest of the two oncology clinics from which data was collected. Figures 5 and 6 display the schemes for the radiation therapy and planning visit groups. As with the Yale AVGs, all of the visit groups shown in these three diagrams stem from the same major diagnostic category. The data shown are from the larger of the two oncology clinics.

Figure 4

Distribution of Total Charges and of Number of Visits To the Outpatient Department of a Comprehensive Cancer Center Using Brandeis-Developed Groups

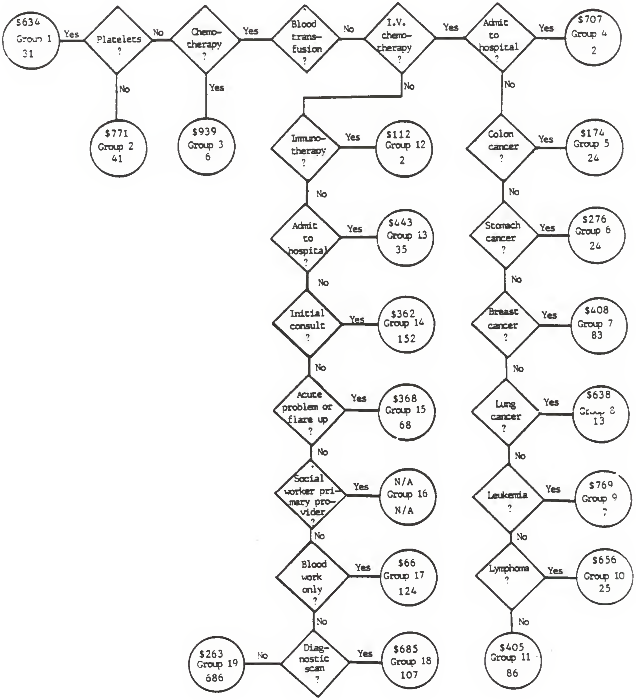


Figure 5

Distribution of Visits - Radiation Treatment Planning Clinic

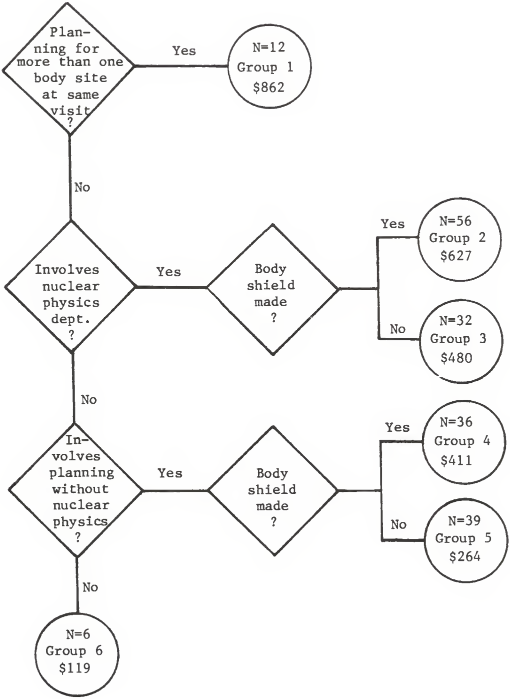
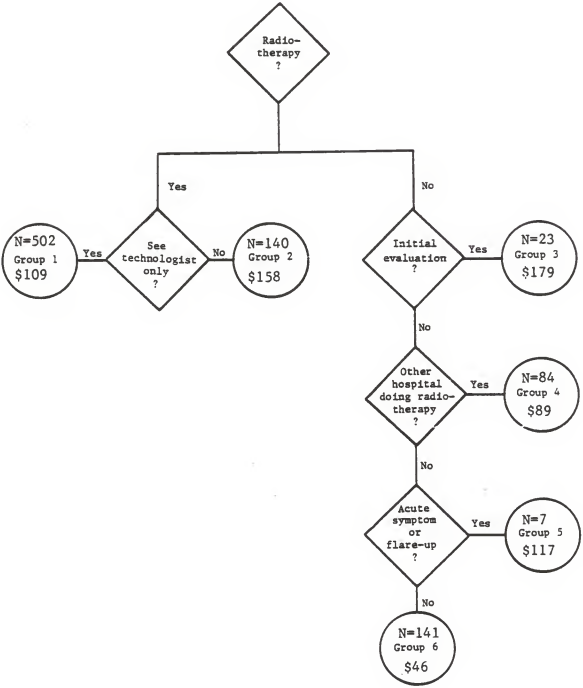


Figure 6

Distribution of Visits to Radiation Therapy Clinic



The same analysis was performed using the Brandeis grouping system. Table 22 shows the results of this analysis for the medical oncology groups. Data was collected in two oncology clinics. Because each clinic had unique billing systems, the charges were too different to combine for this analysis. Shown here are data from the largest of the two clinics.

The Brandeis system was able to better explain variation in resource costs for many of the blood transfusion visits. Red blood cell transfusions and platelet transfusions show coefficients of variation of .34 and .25 respectively. This is an improvement over .37 for the blood products AVG according to the Yale system. Making the chemotherapy groups diagnosis specific, however, did not explain resource use variation better than the Yale system had. Despite this finding, the medical oncologist and oncology administrator working with Brandeis strongly suggested that the groups be split by diagnosis. This is because it was felt that there is substantial difference in case mix between the medical oncology clinics in large teaching and small community hospitals; no community hospitals are included in this data set.

Tables 23 and 24 show the results of the same type of analysis performed on the radiation therapy and planning visits. The higher level of specificity in the Brandeis radiation therapy groups provided the most significant reductions in the coefficients of variation. The data suggest that Yale may want to split its radiation therapy group further.

Table 22

Hierarchy of Total Charges for Visits to Oncology Clinic

Group name	Mean	Standard deviation	Coefficient of variation	Range
Blood transfusion and chemotherapy	$ 939.00	$ 418.23	.45	$ 595 - $ 1,481
Red blood cell transfusion	770.73	259.01	.34	453 - 1,369
I.V. chemotherapy, leukemia	769.14	536.64	.70	245 - 1,868
I.V. chemotherapy, admit to hospital	706.50	17.68	.03	694 - 719
Follow-up with diagnostic scan	684.57	198.91	.29	275 - 1,498
I.V. chemotherapy, lymphoma	656.44	464.27	.71	120 - 2,092
I.V. chemotherapy, lung cancer	637.69	380.21	.60	114 - 1,335
Platelet transfusion	633.52	155.82	.25	423 - 1,041
Admit to hospital	443.26	207.94	.47	100 - 1,054
I.V. chemotherapy, breast cancer	407.76	249.59	.61	92 - 1,343
I.V. chemotherapy, other	405.17	301.53	.74	59 - 1,183
Acute problem or flare up	367.62	287.53	.78	32 - 1,439
Initial consult	362.15	279.83	.77	100 - 2,496
I.V. chemotherapy, stomach cancer	275.58	251.39	.91	68 - 756
Follow-up, ungrouped	263.18	157.36	.60	44 - 1,494
I.V. chemotherapy, colon cancer	173.63	152.98	.88	68 - 515
Immunotherapy	112.00	11.31	.10	104 - 120
Blood work only	66.02	81.29	1.23	14 - 542
All visits	$ 346.70	$ 274.68	.79	$ 14 - $ 2,496

Table 23

Hierarchy of Total Charges for Visits to Radiation Treatment Planning Clinic

Group name	Mean	Standard deviation	Coefficient of variation	Range
Planning for more than one body site	$ 862	$197	.23	$ 528 - $ 1,254
Planning with dosimitry consultation and construction of body shield	$ 627	0	0	$ 627 - $ 627
Planning with dosimitry consultation and no construction of body shield	$ 480	0	0	$ 480 - $ 480
Planning without dosimitry consultation and construction of body shield	$ 411	0	0	$ 411 - $ 411
Planning without dosimitry consultation and no construction of body shield	$ 264	0	0	$ 264 - $ 264
Ungrouped	$ 119	61	.51	$ 68 - $ 215
All visits	$ 479	$ 185	.39	$ 68 - $ 1,254

Table 24

Hierarchy of Total Charges for Visits to Radiation Therapy Clinic

Group name	Mean	Standard deviation	Coefficient of variance	Range
Radiation treatment, technologists only	$ 109	$ 0	0	$ 109 - $ 109
Radiation treatment with physician or nurse examination	158	46	.29	109 - 470
Initial evaluation	179	187	1.05	109 - 750
Routine examination, treatment administered elsewhere	89	76	.85	22 - 445
Acute symptom or flare up	117	108	.92	22 - 338
Follow-up for routine examination	46	76	1.65	22 - 588
All visits	$ 107	$ 62	.58	$ 22 - $ 750

Neither Yale nor Brandeis split the oncology groups based on expensive procedures performed by a pathologist or radiologist and involving only indirect time. The most resource intensive of these procedures are CT scans and extensive laboratory immunology work prior to transfusion of certain blood components. Yale felt that splitting out these groups encouraged the overordering of tests, resulting in a more complicated appearing case mix. Brandeis' attempts to split groups by these two complicated procedures resulted in low coefficients of variation for the final groups for CT scan and immunology laboratory tests. These final groups, however, were judged to have no medical cohesiveness, as measured by their wide variety of oncology diagnoses. They were therefore eliminated from the Brandeis groupings.

CONCLUSIONS

This Final Report has presented the work from a three-year study designed to collect data on clinic visits and to refine an ambulatory visit classification scheme originally developed at Yale University.

The major findings were:

- Physician time (the only resource use variable available in NAMCS) is inappropriate as a measure of hospital clinic resource use. Almost sixteen percent of visits to adult medicine clinics lacked physician time. This reached 23 percent of pediatric clinic visits, about 30 percent of medical oncology visits, and about half of obstetrics-gynecology and radiation therapy visits.

- For adult medicine, physician time is rather highly correlated with provider time (.83) for those visits having physician time. Physician time and provider time are less highly correlated (.63) for medical oncology.

- A resource use measure consisting of weighted physician time and other provider time, added to the cost of all tests ordered or performed at that visit, appears to give the best measure of direct resource use. The correlation between total resource use and physician time were quite low (.32 for adult medicine and .21 for medical oncology).

- Hospital OPDs were substantially and significantly more resource intensive than neighborhood health centers for the same type of visit. Public hospital clinics were slightly but insignificantly more resource intensive for a visit than were voluntary OPDs.

- The most resource intensive primary care AVGs were for cardiology procedures. These were EKG monitoring, cardiac ultrasound and cardiac stress testing. The least expensive AVGs were for pediatrics. These were otitis media in an old patient and ENT trauma in both old and new patients.

- Coefficients of variation for the Yale primary care AVGs are somewhat higher than for the medical DRGs. The Yale oncology AVGs have substantially better coefficients of variation (.37-.88) than do the primary care AVGs.

- Because the Yale medical oncology AVGs were already reasonably tight, the Brandeis group was unable to do much better than the Yale group in reducing variation by splitting the oncology visit groups differently using total resource use.

This study has substantial policy importance in the area of reimbursing for ambulatory care on a case-mix adjusted basis. Independently of reimbursement, comparisons among the product lines of hospital clinics are feasible using the Yale AVGs.

A major caveat indicated by this research involves what measure of resource use is used to weight the AVGs. The research discussed in this report strongly favors measuring resource use as total direct provider time plus the cost of all diagnostic and therapeutic procedures. A further caveat is the lack of data in this or the Yale study for emergency room visits and ambulatory surgery. Including these very resource intensive visits in the weighting scheme would increase the difference between the most and least expensive AVGs in the Yale system to about a thousand-fold. This would make for only miniscule differences in case mix comparisons among clinic settings doing mostly or exclusively primary care.

The Brandeis oncology groups may have more meaning to physicians since they split on actual diagnosis. These groups were unable, however, to effect much of a reduction in variance even while developing a much larger number of groups. For these reasons, it concluded that the Yale oncology groups are at least adequate for the purpose intended.

FINAL RESULTS OF WORK PLAN

This presents our work done under HCFA grant No. 18P-98300 for the three and one half year period April 1, 1983 - September 30, 1986. The deliverables are contained in this Final Report and in the five articles which form part of the Appendices of the Final Report. For easy reference, the location of the final deliverable is specified in the work plan. Modifications to the work plan are also explained.

Task	Product	Time schedule	Progress at end of grant
1. Run Boston and New York primary care clinic teaching hospital data through "frozen trees" of current AVG program and compare with USC-Mendenhall data for internists. Physician time is dependent variable.	Report	3 months	Done
2. Recruit members of Technical Advisory Committee and convene first meeting.	Comments on report	3 months	Done
3. Write program to let variables split freely and add variables such as race, presence and severity of social problem, and third party payer. Physician time is dependent variable.	Program	6 months	Not available as part of Yale program. Done in modified form for Brandeis data and shown in body of final report.
4. On-going liaison with NCHS; decision reached as to whether data scheduled to be collected will be available.		6 months	Done
5. Investigate with Technical Advisory Committee the possibility of using a starting place other than major diagnostic categories for designing the AVGs. Chief complaint could be one alternative.		6 months	Done

	Task	Product	Time schedule	Progress at end of grant
6.	Modify questionnaire used for Boston and New York teaching hospitals and pilot test in one neighborhood health center.		6 months	Done
7.	Examine conversion of other provider time to a common unit of provider time; examine conversion of tests ordered to this common unit.	Report	9 months	Done. Contained in body of final report.
8.	Rerun program using resources used as dependent variable and compare with results obtained in Task 3.	Report	1 year	Done for Yale AVGs. Contained in Appendix IV.
9.	Rerun program using chief complaint or other suggested alternative to major ambulatory categories to determine how alternative affects outcome of AVG splits. Make recommendations.	Report	1 year	Done by Yale. Contained in Appendix IV.
10.	Data collected in remaining six neighborhood health centers, coded, keypunched, put on tape.	Tape and codebook	1 year	Done
11.	With Technical Advisory Committee and hospital financial experts, explore possibility of using charges or costs as dependent variables in AVG analysis.		1 year	Done
12.	Charge data collected in one of three Boston hospitals on patients we have previously collected utilization data on.		15 months	Done
13.	Neighborhood health center data run through AVG program and compared with results in Tasks 3 and 8. Recommendations made for reimbursement policy for hospital OPDs versus free-standing clinics using case mix approach. Report limited to primary care clinics.	Major report	18 months	Done. Contained in Appendices IV and V.
14.	Run USC-Mendenhall data for four tertiary specialties through AVG program described in Task 3.		18 months	Mendenhall data not suitable for use in final Yale AVG program.

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